Rapid Generation of Synthetic Battlespaces for Training and Mission Rehearsal

FY2000

Synthetic Natural Environment Science and Technology Objective (SNE STO) Program

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SNE STO Objective

- ***To research, design, prototype and demonstrate***
  - \+ **Innovative terrain database specification**
  - \+ **Design methodology**
  - \+ **Set of tools**

  - – **Support Army's current and future modeling and simulation terrain database requirements** *efficiently:*
    - **Advanced Concepts and Requirements (ACR)**
    - **Research, Development, and Acquisition (RDA)**
    - **Training, Exercise, and Military Operations (TEMO) user domains**

  - – **Integrate and correlate multiple sources of authoritative data**
    - *e.g. National Imagery and Mapping Agency (NIMA) products, multi-spectrum imagery, text information, and meta-data*

  - – **Leverage Synthetic Environment Data Representation and Interchange Specification (SEDRIS) for data modeling and interchange**
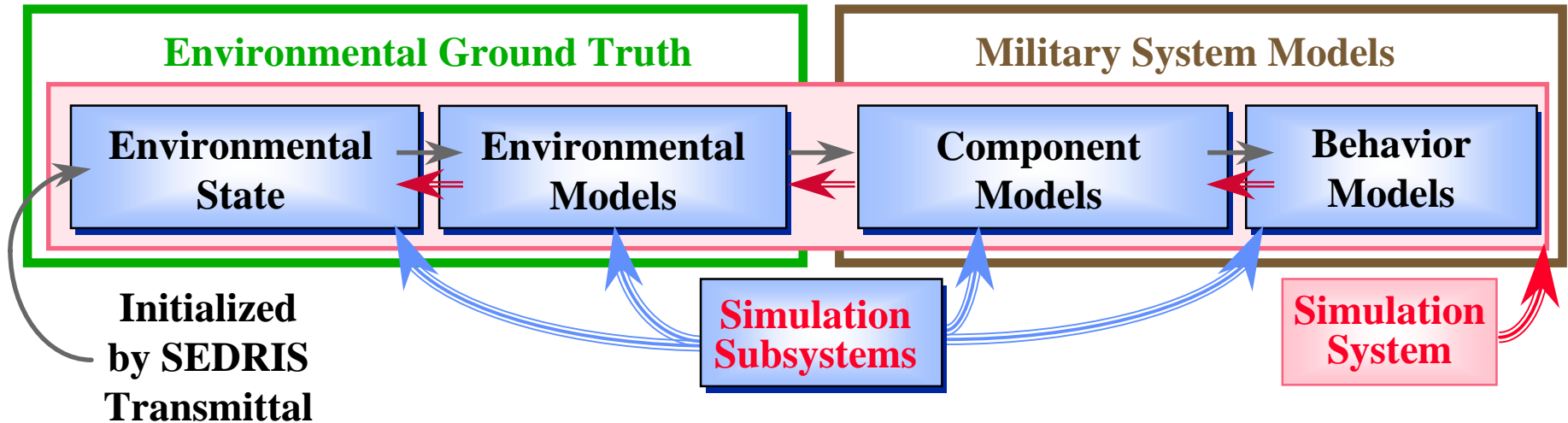   - **Support *rapid* update and intensification; integrate data repositories**

Conceptual Reference Model (CRM) Schema

Environmental Ground Truth

Military System Models

| Environmental State | → | Environmental Models | → | Component Models | → | Behavior Models |

Initialized by SEDRIS Transmittal

Simulation Subsystems

Simulation System

- **Environmental Ground Truth** forms the gaming board
- **Military System Models** comprise the gaming pieces

Military System Models are the measure of success of a simulation

CRM Elaborated

Environmental Ground Truth

Data (e.g.)
- **Terrain**
  (e.g. surface, hydro, veg)
- **Atmosphere**
  (e.g. aerosols, clouds)
- **Ocean**
  (e.g. sea state, SVP)
- **Space**
  (e.g. particle flux, fields)
- **Civilian**
  (e.g. roads, structures)
- **Military**
  (e.g. engineering works)

Effects (e.g.)
- **Propagation**
  (e.g. geometric intervis/TL)
- **Trafficability**
  (e.g. corridor)

Internal Dynamics

Impacts (e.g.)
- **Obscurants/Energy**
  (e.g. smoke, chaff, noise)
- **Damage**
  (e.g. structural, combat engineering, craters)

Military System Models

Passive Sensors

Active Sensors

Weapons & Countermeasures

Units / Platforms

Behaviors (e.g.)
- **Scout**
- **March**
- **Occupy**
- **Target**
- **Fire**
- **Search**
- **Localize**
- **Track**

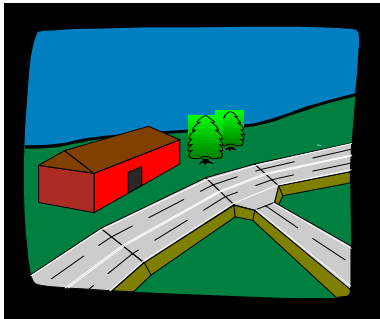- **Environmental Ground Truth = SNE**
  - Composed of both *Data* (terrain, ocean, atmosphere, space)
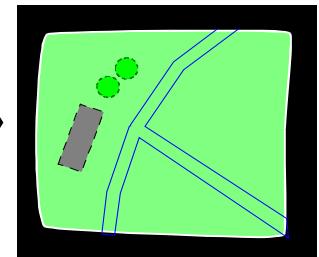 - and *Models* (effects, internal dynamics, impacts)
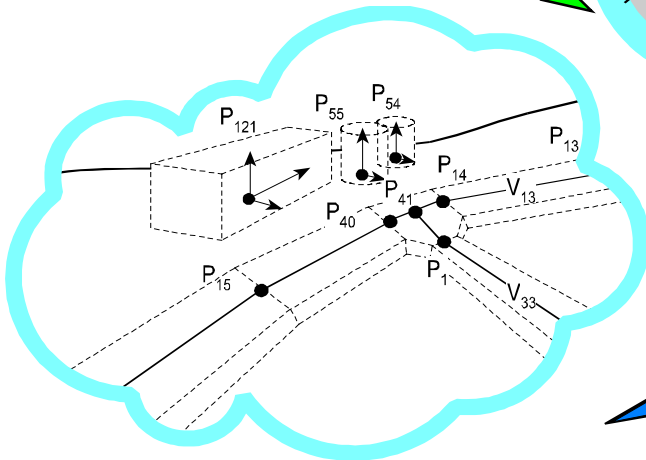
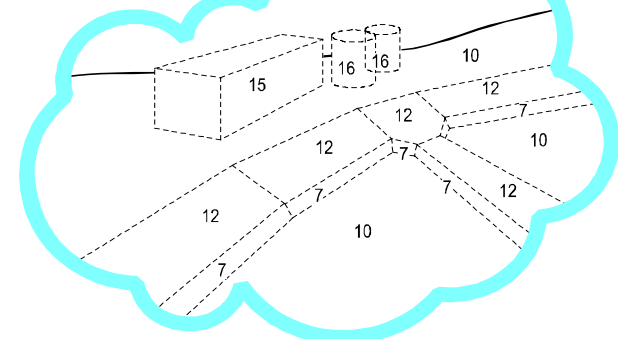# Many Different Views of the Terrain Must Coexist
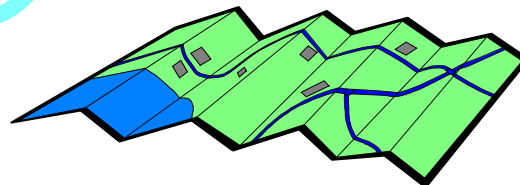

Visual Database

Electronic Maps

Mobility Database

Computer Generated Forces (CGF) Database

Paper Maps

All must be consistent

Complex Terrain Data Base Generation (TDBG) Process

Source Data — *Pre-Processing* — **Interim Data** — *Thin & Merge* — **Master Database** — *Compilation* — **Application**

Feature/Model Development Process

Drawings/Sketches

Vehicle Models

Specifications

3-D Modeling & Texture Tool

Feature Models

Photographs

Reference Models

Libraries

Animation Models

Electronic Maps

Radio Comm Database

SEDRIS Database

Compile

Environment Manager Database

Compile

Compile

Compile

Extract

M E R G E

Synthetic Terrain Development Process

Digital Feature Data

Thinning & Placement Tool

Feature Placement Data

Computer Generated Forces Databases (Mobility & Routing)

Master Visual Database

Digital Elevation Data

Construction & Thinning Tool

Terrain Skin

Compile

Compile

Paper Maps

Example: Kosovo database 6 months; $2M

Visual Database

SNE Database Conceptual Model

Legacy Database

Texture, Photo

NIMA Products

3D Models

Multi-spectrum imagery

Diverse Data Sources

Integrated Terrain Database (TDB) Tool

S E D R I S A P I

Data Source Cleaning Tools

Database Distribution Tool

Data Integration Tools

Database Analysis & Verification Tool

Database Intensification Tools

Database Configuration Management Tool

S E D R I S A P I

Multi-Resolution, Multi-Domain Database Specification and Design Methodology

Semi-Automated Forces (SAF) Compiler

SAF DB

Visual Compiler

Visual DB

Sensor Compiler

Sensor DB

Map Generation

Map

Diverse User Requirements

End-to-End Correlation & Validation

Four Task Areas

4. Terrain Database Generation Technology

Better TDBG Tools and Processes

3. Source Data Analysis / Feedback

Better Terrain Data

Terrain Data Sources

Terrain Database Generation

SEDRIS Transmittal

1. Data Requirements Capture/Modeling

Better Terrain Data

2. Transmittal Requirements Capture/Modeling

Better TDB Specifications

Requirements Task Areas

Terrain Data Sources → **Terrain Database Generation** → **SEDRIS Transmittal**
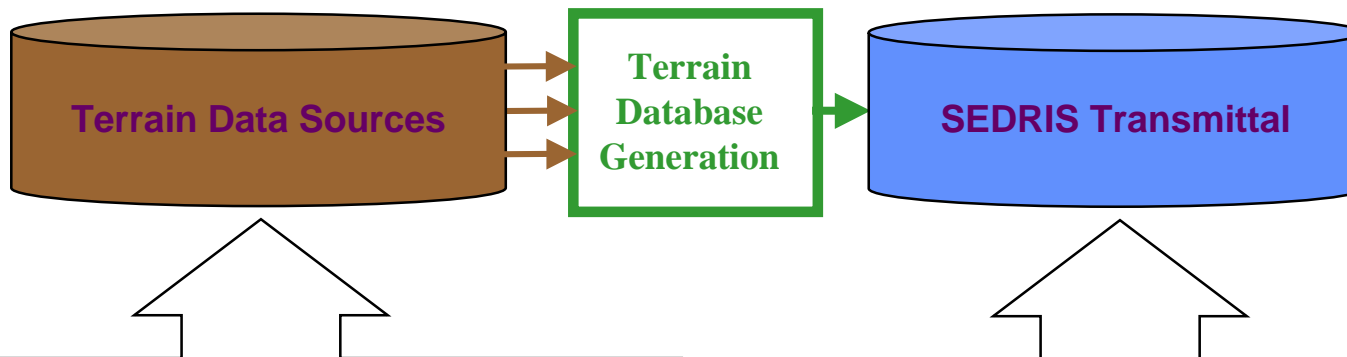
Data Requirements Capture/Modeling

Better Terrain Data

- Reduces cleaning
- Reduces value adding
- Speeds integration, update, and intensification
- Increases basic interoperability with C^4I
- Reduces TDBG software development
- Reduces TDBG manpower

Transmittal Requirements Capture/Modeling

Better TDB Specifications

- Clarify *exact* terrain data requirements
- Allow increased levels of TDBG automation
- Allow automated QA/QC
- Decrease rework
- Decrease overall cost
- Increase reuse
- Increase interoperability
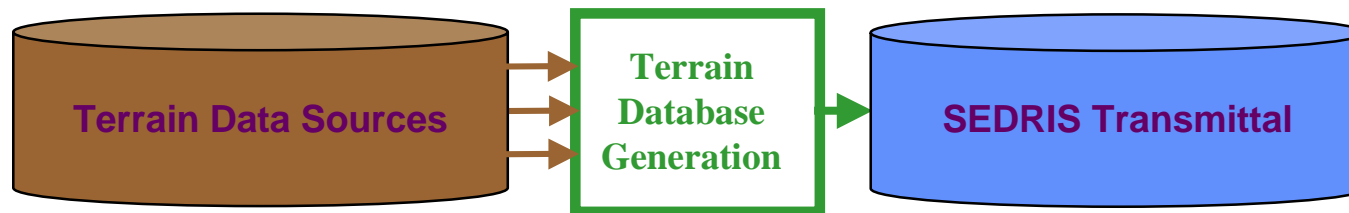
Source Data Task Area

Terrain Data Sources → Terrain Database Generation → SEDRIS Transmittal
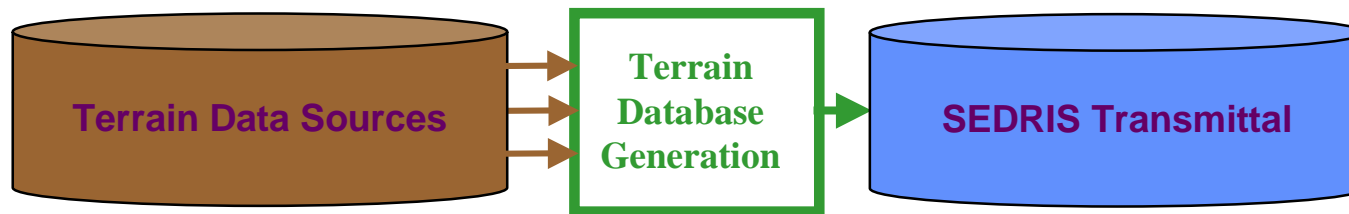
Source Data Analysis and Feedback

Better Terrain Data

- **Evaluate NIMA data and engage in proactive debate**
- **Investigate Rapid Terrain Visualization (RTV) capabilities as alternative data source**

Terrain Data Sources → **Terrain Database Generation** → **SEDRIS Transmittal**

Better TDBG Tools and Processes

- **Increased levels of TDBG automation**
- **Parameter-driven processes**
  - Configured by requirements (data model) and transmittal databases
- **Archived intermediate stores**
- **Integrated intensification tools**
- **Support automated QA/QC**
- **Decrease manual interventions**
- **Decrease overall time / cost**

SNE STO

Rapid Generation of Synthetic Battlespaces for Training and Mission Rehearsal

POC: Bernard Gajkowski
Phone: (407) 384-3681

1. What is the problem?
- **Need common SNE data base generation processes to provide a better, faster, cheaper terrain data base generation capability and process to enable home station training and en route mission rehearsal**

2. What are the barriers to solving this problem?
- **Current process is manpower intensive/not repeatable**
- **Stovepiped process does not support multiple sims**
- **Urban terrain is a major challenge**

3. How will you overcome those barriers?
- **Develop a requirements framework for the synthetic battlespace environment supporting interoperability**
- **Develop common processes and tools to automate and standardize across simulations**
- **Develop infrastructure to build a Common Interoperable Synthetic Battlespace**

4. Where is the requirement identified?
- **TR 97-015 Common Terrain Portrayal**
- **TR 97-056 Synthetic Environment**
- **EN 97-002 Common Terrain Database Management**

5. What is the product of this research effort?
- **Prototype simulation infrastructure, architecture, tools, and processes needed to generate the SNE**
- **Demo candidate standards and metrics for a common process which promotes networked SIM interoperability**

6. Quantitative Performance & Metric
- **What is projected performance?**
- **Reduce Development Time & Cost by 20% initially**
- **Reduce Development Time & Cost by 50% ultimately**
- **What is the current Technical Risk Level (TRL)? TRL=3**
- **What is the projected TRL forecast for FY03 & FY06?**
- **FY03 = 5; FY06 = 6/7**

WHAT IS THE SCHEDULE AND COST?
(Key Milestones)

Tasks	FY00	FY01	FY02
· Analyze Rqmts & Design Process	▮		
· Demonstrate Prototype Infrastructure		▮	
· Design Experiment to Demo Reduced Development Time/Cost		▮	
· Develop Methodology to Assess Interoperability		▮	
· Complete Process Experiment & Test Metrics			▮
· Test Methodology to Assess Interoperability			▮
TOTAL $ 3.3M	Funding ($M)	1.000	1.000	1.300

7. What is the Warfighter Payoff?
- **Enables and facilitates reuse of simulation data and software for training and mission rehearsal**
- **Reduces simulation development and set up time**
- **Provides trainers and evaluators an improved VV&A capability**

8. Transition Milestones:
- **Transitions to WARSIM, JSIMS, and PM CATT in FY03**

9. Endorsements:
- **COL Gunzelman, MMBL**
- **COL Pierce, TPIO-TD**
- **COL Pennypacker, TPIO-SE**
- **LTC Duquette, BCBL**

10. How are you leveraging Non-Army Funding?
- **DARPA Advanced Simulation Technology Thrust for Synthetic Natural Environment - Multi-Resolution Modeling and Testbed**
- **DMSO Synthetic Environment Data Representation & Interchange Specification (SEDRIS)**